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From Lake Nyassa to Philadelphia: a geography of the Zambesi Expedition, 1858–64

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Abstract. This paper is about collecting, travel and the geographies of science. At one level it examines the circumstances that led to Isaac Lea's description in Philadelphia of six freshwater mussel shells of the family Unionidae, originally collected by John Kirk during David Livingstone's Zambesi Expedition, 1858–64. At another level it is about how travel is necessary in the making of scientific knowledge. Following these shells from south-eastern Africa to Philadelphia via London elucidates the journeys necessary for Kirk and Lea's scientific work to progress and illustrates that the production of what was held to be malacological knowledge occurred through collaborative endeavours that required the travel of the specimens themselves. Intermediaries in London acted to link the expedition, Kirk's efforts and Lea's classification across three continents and to facilitate the novel description of six species of freshwater mussel. The paper demonstrates the role of travel in the making of mid-nineteenth-century natural history and in developing the relationships and credibility necessary to perform the research on which classifications undertaken elsewhere were based.

Introduction

In discussing the geography of knowledge during the early modern period, Steven Harris sets a theme that I borrow for this paper: 'How science travels has as much to do with the problem of travel in the making of science as it does with the problem of making science travel.'¹ Prompted by his heuristic, this paper investigates a historical geography of the Zambesi Expedition and how travel and the performance of science were constituent parts of that project.² It examines a collection of zoological specimens made on the expedition by Dr John Kirk, the expedition's botanist. Tracking the movement of specimens and investigating how these paths are created provides insight, I suggest, into how we may place expeditions within larger scientific projects specifically and within the Victorian scientific community more generally. In Harris's paper, the long-distance corporations he examined became the site of knowledge generation, with the

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1 S. Harris, 'Long-distance corporations, big sciences, and the geography of knowledge', *Configurations* (1998), 6, 269–304.

2 I use the spelling 'Zambesi' when referring to the Expedition proper, following contemporary usage; otherwise I use the now more common 'Zambezi'. Lake Nyassa is today referred to as Lake Malawi, though I retain the former name for historical consistency. In all quotations I retain the authors' spelling.

'acquisition, transport, and concentration' of knowledge as the modes through which this composite site is to be understood. 'Situating knowledge and its means of acquisition in the context of corporations allows knowledge production to be viewed both as "local" and as "distributed" without privileging the former over the latter or, more generally, the micro over the macro.'³

In this paper I do not wish to emphasize the local over the distributed or to explore the specific role played by corporations. The network of naturalists analysed here were not part of one institution that could be equated with Harris's corporations. Rather, the Zambesi Expedition, in conjunction with other institutions, forms the 'site' of knowledge generation to be considered. My concern to follow a specimen collection across a scientific community and its institutions entails the description of numerous spaces where knowledge was produced and received. These 'spaces of production' and 'spaces of consumption' and the particular modes of discourse that are internal to them have been analysed by authors interested in the geographical dimensions of science-making and science reception.⁴ David N. Livingstone's ideas of 'spaces of expedition' and 'spaces of circulation' are particularly relevant here and lead us to consider the 'diverse places where science is made'.⁵ Here, the emphasis is on how these diverse spaces are linked through the movement of specimens and people across the globe.

The characterization of natural history as 'a science of networks' has been examined in detail elsewhere.⁶ In her study of early Victorian fieldworkers, Camerini claims that 'relationships pervade the practice of fieldwork', arguing that these relationships served to provide the logistical and epistemic foundations for collecting activities.⁷ In order to become more widely accessible, local knowledge, in the form of specimens, must be transferred to sites where they may be authoritatively analysed. This work of transference (mobilizing teams of collectors and porters, successfully preserving specimens, locating packing materials and finding secure transport out of the field) was, and remains, a complicated affair involving many people.⁸ The sites where analysis is performed, often termed 'centres of calculation' after the work of Bruno Latour, are those social and epistemic spaces where local knowledge is assembled, recorded and unified into

3 Harris, op. cit. (1), 300.

4 J. Golinski, *Making Natural Knowledge: Constructivism and the History of Science*, Cambridge, 1998; S. Shapin, 'Placing the view from nowhere: historical and sociological problems in the location of science', *Transactions of the Institute of British Geographers* (1998), 23, 5–12; C. Smith and J. Agar (eds.), *Making Space for Science: Territorial Themes in the Shaping of Knowledge*, Basingstoke, 1998.

5 D. N. Livingstone, 'Making space for science', *Erdkunde* (2000), 54, 285–96; D. N. Livingstone, *Science, Space, and Hermeneutics*, Heidelberg, 2002.

6 E. Spary, *Utopia's Garden: French Natural History from Old Regime to Revolution*, Chicago and London, 2000, 97.

7 Her chapter also discusses the importance of the Royal Navy as a means of maintaining those relationships. J. Camerini, 'Remains of the day: early Victorians in the field', in *Victorian Science in Context* (ed. B. Lightman), Chicago and London, 1997, 354–77.

8 The methods of fieldwork were prescribed in manuals designed for those who would already have some general knowledge of natural history: J. Herschel and R. Main (eds.), *A Manual of Scientific Enquiry*, 3rd edn, London, 1859; A. Adams, C. Barron and W. B. Baikie, *A Manual of Natural History, for the Use of Travellers*, London, 1854; R. Fitzroy and H. Raper, 'Subcommittee report: hints to travellers', *Journal of the Royal Geographical Society* (1854). The Royal Geographical Society's role in advising travellers is discussed in F. Driver, *Geography Militant: Cultures of Exploration and Empire*, Oxford, 2001, 49–67.

universal knowledge through the use of theories and methods recognized as valid by the wider scientific community.⁹ These institutions were and are themselves locations where the heterogeneous nature of science was played out on a day-to-day basis in the varied work of preserving, identifying, cataloguing, displaying and viewing specimens.¹⁰ Specimens can act as boundary objects in these situations, remaining identifiable to all the groups, but employed to fill different requirements by each.¹¹

It has been argued that the combined analytical work performed at centres of calculation cannot be done singly, but requires the work of a community. ‘Universality, objectivity, and accumulation are not characteristics of technoscientific knowledge itself, rather they are effects produced by the collective work of the technoscientific community.’¹² This empirical transformation from local knowledge to the universal ‘view from nowhere’ has come under increased investigation. The concept of travel between scientific sites – the travel of facts, standards, techniques and materials – has been marked as an important area for study as some scholars move away from focusing on specific locales to analysis of more widely distributed scientific activity.¹³ In discussing this ‘spatial turn’ in science studies, D. N. Livingstone has noted that where scientific practices are spatially distributed the issues of credibility and expertise, and the institutions that maintain them, become critically important to our understanding of how such practices are sustained.¹⁴ Unlike individuals invited to observe Boyle’s air-pump demonstrations, few natural historians in the nineteenth century had the opportunity to directly observe tropical specimens *in situ*.¹⁵ Unverifiable faith in the credibility of the collector as reporter remained for Victorian naturalists a critical, if continually problematic, characteristic of scientific analyses of the world’s flora and fauna.

With these ideas in mind, this paper approaches the scientific work of the Zambesi Expedition by examining the links that connect the field and the museum, the collector

9 B. Latour, ‘Circulating reference: sampling the soil in the Amazon forest’, in *idem*, *Pandora’s Hope: Essays on the Reality of Science Studies*, Cambridge, MA, 1999, 24–79. See also, more generally, B. Latour, *Science in Action*, Cambridge, 1987.

10 Examples of work that deal specifically with the construction of natural history collections include S. Alberti, ‘Placing nature: natural history collections and their owners in nineteenth-century provincial England’, *BJHS* (2002), 35, 291–311; C. Stelzig and K. Adler, ‘On the preconditions, circumstances, and consequences of collecting: Jan Czekanowski and the Duke of Mecklenburg’s expedition to Central Africa, 1907–8’, *Journal of the History of Collections* (2000), 12, 161–76; M. Rodrigues De Areia and M. Pereira Miranda, ‘A philosophical journey to the Amazon, 1883–92: the story of the gathering and dispersal of a collection’, *Journal of the History of Collections* (1995), 7, 59–71; S. Sheets-Pyenson, ‘How to “grow” a natural history museum: the building of colonial collections, 1850–1900’, *Archives of Natural History* (1988), 15, 121–47.

11 S. L. Star and J. Griesemer, ‘Institutional ecology, “transitions” and boundary objects: amateurs and professionals in Berkeley’s Museum of Vertebrate Zoology, 1907–39’, *Social Studies of Science* (1989), 19, 387–420.

12 D. Turnbull, ‘Travelling knowledge: narratives, assemblage and encounters’, in *Instruments, Travel and Science: Itineraries of Precision from the Seventeenth to the Twentieth Century* (ed. M.-N. Bourguet, C. Licoppe and H. O. Sibum), London and New York, 2002.

13 C. Withers, ‘Reporting, mapping, trusting: making geographical knowledge in the late seventeenth century’, *Isis* (1999), 90, 497–521; Shapin, *op. cit.* (4).

14 D. N. Livingstone, ‘The spaces of knowledge: contributions towards a historical geography of science’, *Environment and Planning D: Society and Space* (1995), 13, 5–34.

15 S. Shapin and S. Schaffer, *Leviathan and the Air-Pump: Hobbes, Boyle and the Experimental Life*, Princeton, 1985.

and the analyst. The focus will be on uncovering the forms of travel that were necessary to transform unknown mussels found in a lake that had only recently appeared on European maps into regimented examples of the typical molluscan fauna of Lake Nyassa that slotted easily into pre-established taxonomies. The paper will begin with a description of the Zambesi Expedition and its multifaceted instructions from the Foreign Office. The main agents in the story – the mussels, Sir John Kirk and Isaac Lea – will then be introduced before turning to a discussion of how the mussels travelled the globe in the early 1860s.

The Zambesi Expedition

The Zambesi Expedition worked in the field from March 1858 until early 1864. The leader of the expedition was David Livingstone. The Scottish explorer was at the height of his fame in 1857, having published late that year his *Missionary Travels and Researches in South Africa*, an account of his explorations in the region including details of a trans-African walk from the Atlantic to the Indian Ocean that enthralled the Victorian public.¹⁶ In respect of the Zambesi Expedition, Livingstone was appointed ‘H. M. Consul at Quelimane for the Eastern Coast and independent districts of the interior, and commander of an expedition for exploring Eastern and Central Africa, for the promotion of Commerce and Civilisation with a view to the extinction of the slave-trade’.¹⁷ His instructions from the government included scientific, humanitarian and economic activities. These interests represented the ‘blending of diverse missions where African affairs are concerned’, an amalgamation of purposes typical of government-sponsored Victorian African exploration.¹⁸ The purposes were linked via a civilizing-mission ideology that joined commerce, Christianity and civilization in one grand plan essentially to ‘modernize’ African society whilst providing raw materials for British industry. The main tenets of this ideology held that by increasing communication between ‘civilized’ and ‘uncivilized’ cultures through commerce, the process of ‘opening up’ Africa to British trade would result in an end to the barbarism assumed to exist there. Livingstone and other like-minded missionaries had faith that Christianity would quickly follow in commerce’s footsteps. To this end the natural resources of the region first had to be investigated via expeditionary science.

The overall plan for the Zambesi Expedition was to pilot a river steamer up the Zambezi river and set up a base of operations near the capital of Chief Sekeletu, Linyati, located on the Batoka Plateau (now western Zambia). The highland region was chosen because it was considered to lie at a sufficient altitude to reduce the threat of malarial fevers and was far enough inland to avoid diplomatic wrangling over Portuguese territorial claims along the lower Zambezi. Livingstone had earlier developed a friendly relationship with Sekeletu and considered the monarch to be supportive of his plans to introduce legitimate, non-slave-based commerce and Christianity. From

16 D. Livingstone, *Missionary Travels and Researches in South Africa*, London, 1857.

17 G. Seaver, *David Livingstone: His Life and Letters*, London, 1957, 308.

18 Driver, op. cit. (8). P. Raby, *Bright Paradise: Victorian Scientific Travellers*, Princeton, 1996 discusses the links between free trade and civilization. D. G. Burnett, *Masters of All They Surveyed: Exploration, Geography and a British El Dorado*, Chicago and London, 2000 discusses the close relationships between science and colonial administration on expeditions to the interior of British Guiana in the early nineteenth century.

this central 'depot', the surrounding region would be analysed by the naturalists, its resources catalogued and specimens collected.¹⁹ It was also hoped that the 'moral influence' of this group of Europeans would have a positive impact on the social mores of the surrounding communities.

Following the precedent of Foreign Office expeditions to the Niger in West Africa, the logistics of transport and correspondence were placed in the control of the Admiralty, specifically Captain John Washington, chief hydrographer.²⁰ In organizing the scientific work and selecting the collectors who would accompany Livingstone, leading members of the Royal Geographical Society (RGS), the Royal Society, the British Museum, Kew Gardens and the Kew Observatory offered advice concerning whom to appoint and provided the training necessary for making appropriate observations. Because the expedition was to be funded by public money, specimens collected in the field were to become the property of the British government and sent either to Kew Gardens or to the British Museum for analysis and first refusal.²¹

Various types of expertise were necessary to organize the expedition. A politician, a botanist, a zoologist, a geologist and a geophysicist wrote separate letters of instruction for members of the expedition.²² Steamships were built on Merseyside to be used for transport on the Zambezi.²³ British diplomats placated Portuguese fears that the expedition possessed ulterior motives to extend British power into an area that had been nominally Portuguese since the early sixteenth century.²⁴ The tasks of handling correspondence and provisions for the expedition fell to the Admiralty ships stationed at Simon's Bay, Cape Town. While expeditions connote an image of heroically self-sufficient explorers hacking through the jungle, the truth was to the contrary; the Zambesi Expedition involved hundreds of people performing mundane tasks in support of the few who received the public's adulation and the plaudits of their peers. As Camerini concluded in her study of the fieldwork of Darwin, Joseph Hooker, Huxley and Wallace, 'The scientific arenas of natural history ... are all collective enterprises.'²⁵

19 So called by Livingstone in his letters of instruction to the members of the expedition. See appendices for J. P. R. Wallis (ed.), *The Zambesi Expedition of David Livingstone, 1858–1863*, 2 vols., London, 1956.

20 John Washington (1800–63) was promoted to rear admiral in 1862. His papers relating to this expedition reveal in great detail the bureaucracy of managing the 'home' side of a government expedition; Royal Naval Museum Library, Portsmouth (hereafter RNML) (MSS 120).

21 Kew's position at the centre of a worldwide network of gardens and collectors during the mid-nineteenth century is detailed in R. Drayton, *Nature's Government: Science, Imperial Britain, and the 'Improvement' of the World*, New Haven and London, 2000; and D. P. McCracken, *Gardens of Empire: Botanical Institutions of the Victorian British Empire*, London and Washington, 1997.

22 For Livingstone's letter of instruction see Foreign Office to David Livingstone, 25 February 1858, Appendices, RNML (MSS 120). Instructions for the other members are published in Wallis, op. cit. (19).

23 The expedition's first paddle steamer, *Ma Robert*, spectacularly failed to live up to expectations, due largely to Livingstone's exaggerations of the navigability of the Zambezi River complicated by use by the builder, Macgregor Laird, of a novel but rust-prone type of steel hull in its construction. See J. G. Parr, 'The sinking of the *Ma Robert*: an excursion into mid-nineteenth-century steelmaking', *Technology & Culture* (1972), 13, 209–25.

24 For the history of the region, see S. L. Ishemo, *The Lower Zambezi Basin in Mozambique: A Study in Economy and Society, 1850–1920*, Aldershot, 1995; and M. D. D. Newitt, *Portuguese Settlement on the Zambesi: Exploration, Land Tenure and Colonial Rule in East Africa*, Harlow, 1973.

25 Camerini, op. cit. (7), 373.

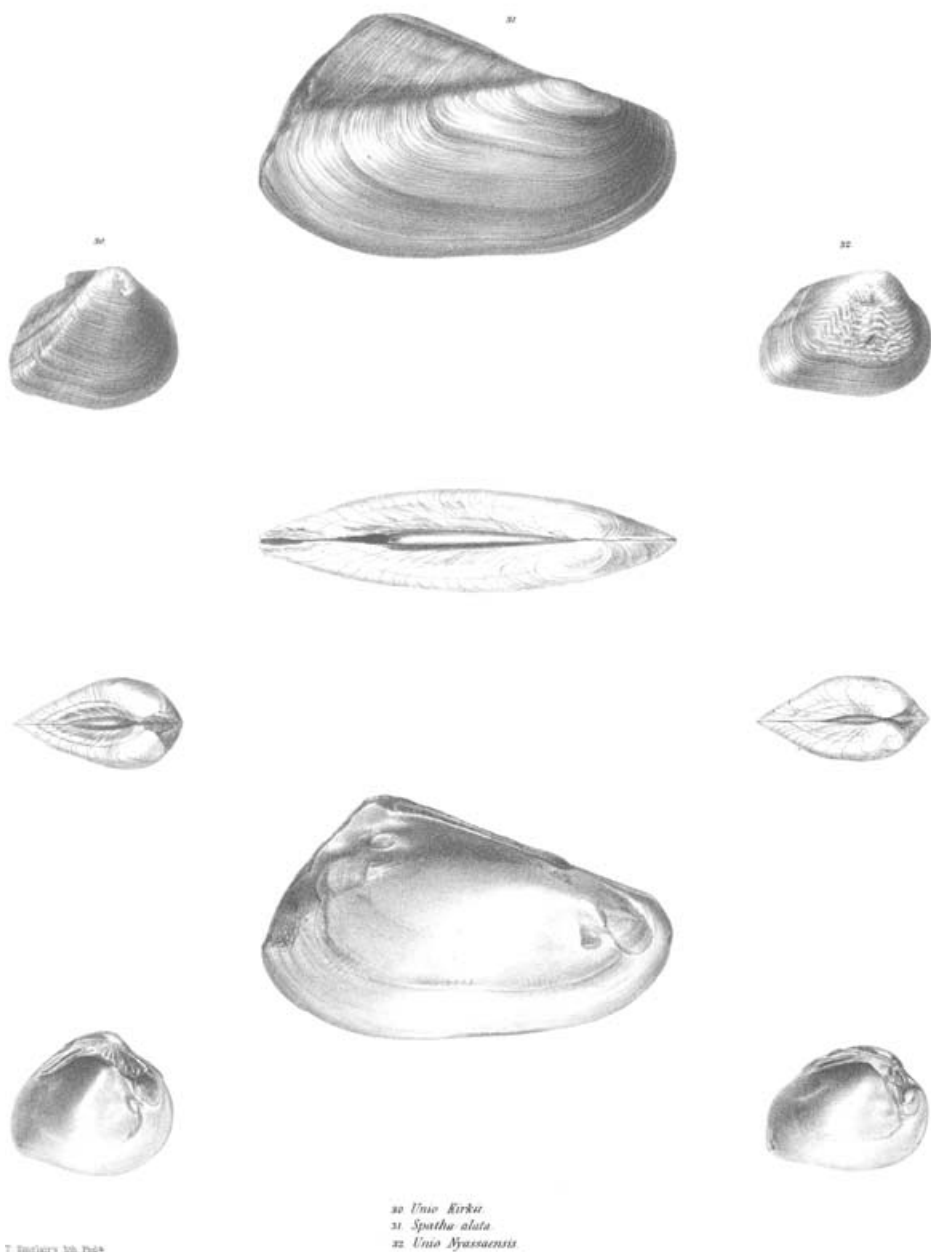


Figure 1. Unionid mussels collected by John Kirk (courtesy of the Academy of Natural Sciences of Philadelphia).²⁶

26 This plate appears in I. Lea, 'New Unionidae, Melanidae, etc., chiefly of the United States', *Journal of the Academy of Natural Sciences of Philadelphia* (1866), NS, 6, Plate 12.

The mussels

Malacology, the study of molluscs, attracted persons interested in scientific questions as well as those who were enthralled with shells as decorative objects.²⁷ The ease of preserving and transporting mollusc shells made them an ideal object of study for the sedentary museum curator or cabinet-based investigator interested in teasing out taxonomic puzzles. The existence of molluscs in the fossil record readily connected them with geological questions, offering a perfect bridge between geology and biology for the Victorian polymath. The mussels under consideration here – those collected by Kirk and described by Lea – are all part of the Unionidae, a large family of freshwater molluscs containing around a thousand species.²⁸ Although most widely distributed in North America – hence the name – unionids are found all over the world.

The path of the mussels is best followed by beginning at the end, with their description. In 1865 some of the mussel specimens Kirk collected were described by Heinrich Dohrn in the *Proceedings of the Zoological Society of London*. Heinrich (1838–1913) was a noted zoologist who had taken his Ph.D. from Berlin in 1861.²⁹ He was the brother of the more famous pioneer of marine biology Anton Dohrn (1840–1909). Their father, Carl Augustus Dohrn (1806–92), was a successful entomologist. Although most of Heinrich's papers and collections were destroyed during the Second World War, there is evidence for the likelihood that he had seen shells from the Zambezi while studying in Berlin, where Wilhelm Peters, who had collected along that river in the 1840s, was Professor of Zoology.³⁰ In his description of Kirk's specimens, Dohrn lamented the absence of certain shells that he knew were originally part of the collection sent to him for description:

I regret very much that there are no Unionidae in the collection which I got for examination. All I can state from the above list [of species] is, that the conchological fauna of Lake Nyassa seems to belong to the same region with Natal; but most of the freshwater species from the lake having turned out to be hitherto unknown, and some of the other species having been found by Captain Speke and others far more northwards, it is rather difficult to come to any conclusion from the present collection.³¹

27 Malacology includes both the soft and hard parts of molluscs while conchology is only concerned with the shells. Recent discussion of the history of the discipline includes S. P. Dance, *A History of Shell Collecting*, Leiden, 1986. On aspects of the decorative in malacology and its tension with objectivity, see E. Spary, 'Scientific symmetries', *History of Science* (2004), 42, 1–46.

28 J. E. Morton, *Molluscs*, 5th edn, London, 1979, 209.

29 Thanks are due to Dr Christiane Groeben, archivist at the Stazione Zoologica 'Anton Dohrn' in Naples, Italy (founded by Anton in 1874), for her assistance over this 'forgotten' naturalist of the Dohrn family. C. Groeben (ed.), *Correspondence: Karl Ernst Von Baer, Anton Dohrn*, Philadelphia, 1993, 32.

30 The importance of Heinrich's collections is discussed in Dance, op. cit. (27), 158. Peters published his Zambezi specimens as a series of volumes: W. C. H. Peters, *Naturwissenschaftliche Reise nach Mossambique*, 5 vols., Berlin, 1852–82. For further information on Peters see A. Bauer, R. Günther and M. Klipfel, *The Herpetological Contributions of Wilhelm C. H. Peters*, Ithaca, 1995.

31 H. Dohrn, 'List of the land and freshwater shells from the Zambezi and Lake Nyassa, Eastern Tropical Africa, collected by John Kirk, M.D', *Proceedings of the Zoological Society of London* (1865), 231.

Elsewhere in the article Dohrn quoted a letter from Kirk, which explains the absence:

The Unionidae of the lake having previously been described and figured by Isaac Lea, in a paper read before the Academy of Natural Sciences of Philadelphia, April 12th, 1864, are not here included. They number six species, and one still remains undescribed.³²

Why would six shells out of the Lake Nyassa collection have been removed in this way, especially when their removal hindered Dohrn's task of drawing conclusions about their geographic distribution in respect to other African collections? The unique unionid specimens, most likely new species, were specifically separated from the main collection and sent to Philadelphia, Pennsylvania for description by Isaac Lea while Dohrn received the remainder. A closer look at Lea and his relationship with the British Museum may help answer this question and illustrate the networks of correspondence and credibility through which the shells were moved.

Isaac Lea (1792–1886)

Isaac Lea was born in Wilmington, Delaware in 1792 and moved to Philadelphia in 1807 to work in his eldest brother's importing house.³³ He married into the family of Matthew Carey and in 1821 became a partner of the leading Philadelphia-based publishing house, M. Carey & Sons. Aside from his publishing career, Lea maintained an avid interest in geology and natural history which he had developed in his youth. In 1815, at the age of 23, Lea was elected to the recently formed Academy of Natural Sciences of Philadelphia (ANSP).³⁴ In 1827 he published his first article on the little-studied molluscan genus *Unio* in the Academy's journal.³⁵ The following year he was elected to the American Philosophical Society (APS).

Through his many articles, normally published in the Academy's *Journal* and *Transactions* and the *Transactions of the American Philosophical Society*, Lea's expertise on the Unionidae spread.³⁶ The ANSP exchanged journals with many societies throughout Europe, as did the APS. Unbeknownst to him, Lea's early work was widely read by European malacologists, a fact that would surprise him during his first trip to Europe.

32 Dohrn, op. cit. (31), 234.

33 My discussion of Lea's life is based upon the introductory biography in *The Published Writings of Isaac Lea* (ed. N. P. Scudder), *United States National Museum Bulletin* (1885), 23; and A. E. Bogan and C. M. Bogan, 'The development and evolution of Isaac Lea's publications on the Unionida', in *Collectanea Malacologica: Festschrift für Gerhard Falkner* (ed. M. Falkner, K. Groh and M. C. D. Speight), Hackenheim, 2002, 363–75. Copies of his journals are found in the Academy of Natural Sciences of Philadelphia (hereafter ANSP) (Coll. 452: correspondence and papers of Isaac Lea) and the American Philosophical Society (hereafter APS) (L462: Lea, Isaac, Notes of Travel, European Journal 1852–53). More of Lea's papers are found in the Smithsonian Institution Archives, Washington, DC (Record Unit 7065: Isaac Lea Papers). See also DSB.

34 Lea served as the Academy's president from 1853 to 1858. His first article appeared in the 1817 volume of its *Journal* under the title 'An account of the minerals known to exist in the vicinity of Philadelphia'. Lea's early fieldwork occurred very close to home, in the style of many eighteenth-century European collectors. See A. Cooper, 'From the Alps to Egypt (and back again): Dolomieu, scientific voyaging, and the construction of the field in eighteenth-century natural history', in Smith and Agar, op. cit. (4), 39–63.

35 DSB.

36 Lea published almost exclusively in these publications; see his complete bibliography in *Published Writings*, op. cit. (33).

Lea travelled during his life, but he did not, except in his early youth, travel to collect in the field. Rather, from his base in Philadelphia, Lea courted relationships with collectors throughout North America and the wider world, using family and business relations where possible. As his knowledge grew, along with the reputation of the ANSP, many specimens began to appear unsolicited. This abundance of natural history specimens provided a firm foundation for Lea's analysis of Unionidae systematics. Well supplied, he was able to work in his cabinet like an American Cuvier, exploring the waterways of North America by allowing others to do the fieldwork for him.³⁷

Lea took two extended trips to Europe. The first occupied much of 1832 (April to November); the second took place between June 1852 and November 1853. The trips were very much 'grand tours' of Europe, although they also included frequent visits with leading scientists and their institutions. Upon arrival in London on his first trip one of his first scientific acts was to meet John George Children and John Edward Gray at the British Museum on 4 May 1832.³⁸ Lea was surprised to learn from them that his most recent memoir on *Unio* had been read to the Royal Society the night before.³⁹ The subsequent pages of his journal list one introduction after another, as well as a flurry of invitations to scientific meetings. Upon meeting Michael Faraday he was invited to the evening meetings of the Royal Institution (7 May 1832). Lea called on Charles Babbage and then Charles Lyell (11 May). At the Geological Society Lyell introduced Lea to Sir Roderick Murchison, from whom invitations to their meetings were extended.⁴⁰ As Lea's expertise in malacology became recognized, he was often asked to rearrange others' collections according to his ideas on molluscan systematics.⁴¹ He also presented many of the people and institutions he visited with specimen collections.⁴² After nearly a month in London, Lea and his family travelled to Oxford in June 1832 so that he could attend the annual meeting of the BAAS. From England Lea then travelled to Paris, Belgium and Switzerland, frequently visiting naturalists and collections, before returning to Philadelphia in late 1832.

After retiring from the publishing house in late 1851, Lea returned with his family to Europe, arriving in Liverpool in June 1852. They travelled quickly through England to Paris to begin an extended tour of Germany, France, Italy, Austria, the Netherlands and Belgium. They returned to England in September 1853, in time for the meeting that year of the BAAS in Hull. As on the first trip, Lea visited natural scientists wherever he went. At the University of Berlin Lea met Professor Lichtenstein, who showed him a collection

37 On this point, see D. Outram, 'On being Perseus: new knowledge, dislocation, and enlightenment exploration', in *Geography and Enlightenment* (ed. D. N. Livingstone and C. Withers), Chicago and London, 1999, 281–94.

38 Children (1777–1852) worked at the Zoological Department from 1823 to 1840. Gray (1800–75) worked with Children from 1824 and succeeded him as keeper until retiring in 1863.

39 It appears strange that Lea was unaware of his paper being read and equally strange that the Royal Society did not know of the author's presence. It is possible that his arrival was truly unannounced. Certainly it is likely that Lea had little direct knowledge of London's scientific society, if we may judge by the almost daily mentions of introductions to members of that community in Lea's journals.

40 Murchison (1792–1871) was currently serving as the society's president.

41 'At the request of Mr. [John Edward] Gray I named all the Unionidae, some of which had erroneous names', Isaac Lea, diary entry, 21 May 1832, ANSP (Coll:452).

42 Presenting specimens as a socially bonding act is described in Cooper, op. cit. (34), 46.

of shells brought back from the Zambezi River by Wilhelm Peters in the 1840s. These were probably the first species of *Unio* from south-eastern Africa that Lea had seen.⁴³

While in London Lea regularly visited the British Museum and became good friends with Henry Thomas De La Beche and Richard Owen. He assisted both in the organization of specimens and discussed lecturing possibilities for them in the US. Shortly before leaving Europe for the last time, Lea was invited to speak about Pennsylvanian fossils at the Philosophical Club of the Royal Society (27 October 1853). At the end of the meeting he talked with William Benjamin Carpenter about possibilities for him to move to a professorship in Philadelphia. Lea recorded the mundane reason for this in his diary: 'Carpenter's salary at University College is nothing like the payment of a chair in our colleges at Philadelphia.'⁴⁴

Reading Lea's journal reveals how important his trips to Europe were for his reputation as a scientist. He helped to arrange specimens at the British Museum, the Jardin des plantes and the University of Berlin. He attended soirées at the Murchisons', chatted with Alexander von Humboldt in Berlin and was given a dinner by Prince Charles Bonaparte in Paris. During his two trips to Europe, Lea defined (and claimed) his area of expertise by meeting other naturalists, discussing theory, arranging collections and exchanging specimens. As I will show, this reputation assists our understanding of the shells' route and Lea's connection to Sir John Kirk.

Sir John Kirk (1832–1922)

Born the son of a minister in Forfarshire, John Kirk was not wealthy, unlike Isaac Lea.⁴⁵ He became interested in natural history, especially in botany, while studying medicine at the University of Edinburgh. There he had been a student of John Hutton Balfour, Dean of the Medical Faculty, Regius Keeper of the Royal Botanical Garden in Edinburgh and Queen's Botanist to Scotland.⁴⁶ Balfour was one of the founders of the Botanical Society of Edinburgh in 1836. After graduating, Kirk volunteered to serve as part of the Civil Hospital Staff during the Crimean War.

Due to administrative troubles while in Asia Minor, Kirk unexpectedly found himself with free time to botanize in the area.⁴⁷ He also travelled to Syria and Egypt and collected there. Upon returning to England in the spring of 1857 he consulted Sir William Hooker at Kew Gardens about his specimens.⁴⁸ This would appear to have been one of their first meetings. By the end of the year, Kirk was offered the post of economic botanist and chief medical officer to accompany Livingstone on his return to southern Africa at the head of a government expedition.

43 *Published Writings*, op. cit. (33), 29.

44 Lea, diary entry, 27 October 1853, APS (L462). Carpenter (1813–85) was the Fullerian Professor of Physiology at the Royal Institution and Professor of Forensic Medicine at University College.

45 Two biographical treatments of Kirk exist: R. Coupland, *Kirk on the Zambesi: A Chapter of African History*, Oxford, 1928; and D. Liebowitz, *The Physician and the Slave Trade: John Kirk, the Livingstone Expeditions, and the Crusade against Slavery in East Africa*, New York, 1999.

46 Balfour (1808–84) graduated in medicine from Edinburgh in 1831 and was dean of its Medical Faculty from 1849 to 1879. DSB.

47 Coupland, op. cit. (45), 57.

48 Coupland, op. cit. (45), 62.

Kirk was offered a post on the Zambesi Expedition because he had succeeded in medical school and proved his hand at fieldwork around the eastern Mediterranean. He was young – twenty-five – in good health and in possession of ‘travellers’ credentials. His qualifications as a physician made him doubly useful to the expedition. Two major figures in botany at the time recommended him: Balfour and William Hooker. Four weeks before Kirk was first named to accompany Livingstone, Sir William Hooker recommended Kirk as a suitable candidate for the Chair in Natural History at the University of Kingston, Ontario: ‘He has, since he completed his education, improved himself by travel, especially in the East.’⁴⁹ In first mentioning Kirk, Livingstone writes of the young doctor’s successful travels in Egypt and Palestine as part of his credentials.⁵⁰ Mention of the specific botanical work Kirk performed while travelling is noticeable by its absence. A key reason for his appointment lay, then, in his having ‘proved’ himself in a foreign field. His trip to Asia Minor was judged a rite of passage, providing foreign experience necessary for his further career.⁵¹ Thus certified, Kirk was predetermined to be trustworthy and a credible reporter of natural phenomena.⁵² Once on site in the Zambezi basin, he would interpret nature for those not present and, more importantly, pack up bits of nature and transport them home. This process will be examined next.

Expedition geography: making mussels move

Kirk collected the mussels on Lake Nyassa in September or October 1861, though he does not record the exact date.⁵³ During this period Kirk, David and Charles Livingstone, John Neil, an able seaman, and ‘a score of attendants’ travelled nearly the whole length of the lake in a small sailboat with a following shore party.⁵⁴ It was a difficult trip and offered limited opportunities for collecting due to the speed of their travel and a lack of porters to carry specimens. Their main intention was to record the dimensions of the lake and determine its place in the region’s hydrography. It may be that Kirk did not collect the specimens himself but utilized local assistants or was presented with the shells, or even that he purchased them at a market; these are all methods of acquiring specimens he describes elsewhere in his journals.⁵⁵

49 23 November 1857, National Library of Scotland (hereafter NLS) (ACC 9942/49).

50 Livingstone had wanted Joseph Hooker to serve in this position. The younger Hooker opted to stay home due to family concerns and his increased responsibilities at Kew. His refusal to join the expedition bothered Livingstone for some years. See D. Livingstone to J. Hooker, 26 October 1857, 28 December 1857 and 9 December 1861, NLS (MS 10779/10a).

51 On this point more generally, see M. Rudwick, ‘Geological travel and theoretical innovation: the role of “liminal” experience’, *Social Studies of Science* (1996), 26, 143–59.

52 Being appropriately known to the audience community was critical for holding credibility when reporting on distant nature. See C. Withers, ‘Travel and trust in the eighteenth century’, in *L’Invitation au voyage* (ed. J. Renwick), Oxford, 2000, 47–54; and, more generally, S. Shapin, *A Social History of Truth*, Chicago and London, 1994.

53 Kirk’s journals are published in R. Foskett (ed.), *The Zambesi Journal and Letters of Dr. John Kirk, 1858–63*, 2 vols., Edinburgh, 1965. Most of the originals are now held as NLS (ACC 9942/21–24).

54 D. Livingstone and C. Livingstone, *Narrative of an Expedition to the Zambesi and Its Tributaries and of the Discovery of the Lakes Shirwa and Nyassa, 1858–1864*, London, 1865, 274.

55 Foskett, op. cit. (53), passim.

The group returned to the main body of the expedition, who were waiting for them at the first cataracts of the Shire River, on 8 November 1861. Their boat, HMS *Pioneer*, was readied and the group started downstream in the hopes of meeting an Admiralty ship at the delta of the Zambezi. Unfortunately, they ran aground on a sandbank and remained stuck for over a month waiting for the river to come into flood. While idle, Kirk wrote letters to Joseph and William Hooker describing the flora and fauna along the western shore of Lake Nyassa. The first letter was written on 6 December 1861 to William Hooker and mentions the Lake Nyassa shells specifically.⁵⁶ Kirk had packaged up a number of crates and he requested that a small tin box of shells, packed inside a larger case, be forwarded to 'Professor Owen'. The next letter to William Hooker written nearly two weeks later indicates that Kirk removed the tin box of shells from the larger box along with some cotton samples and oil nuts.⁵⁷ It appears that there was a chance to send a small number of packages ahead to the coast by canoe, and Kirk thought to send the small tin box of shells ahead instead of keeping them with the bulk of his collection, stuck on the sandbank.⁵⁸ In the letter he again indicated that the shells should be forwarded to Owen and requested, 'if he sends me the names of them I should be much obliged'.⁵⁹ By mid-January the chance to send some correspondence ahead had not materialized and the tin box of shells was back in its original crate, marked 'for Prof. Owen'.⁶⁰ The river rose and the *Pioneer* finally reached the coast on 20 January. HMS *Gorgon* met them there on 31 January to transfer correspondence and supply provisions.

Confident the shells were finally on their way, Kirk wrote to Richard Owen on 15 March 1862 to alert him of the new specimens. The expedition was busy transporting pieces of their third steamer, *Lady Nyassa*, upriver from the mouth of the Zambezi as they unloaded them from HMS *Gorgon*. The letter opened with Kirk writing,

I send through Sir W. J. Hooker a collection of shells from the borders of Lake Nyassa. Among them I doubt not you will find several new ones. They will at least be interesting as I think it contains more species than any other collection from the Lake Regions.⁶¹

In the last sentence of this passage, Kirk is alluding to the mussel shells collected by Richard Burton and John Hanning Speke on their East African Expedition.⁶² Although Kirk was located somewhat remotely in the field, news of developments elsewhere reached him through correspondence and influenced the way he saw his own specimens

56 John Kirk to William Hooker, 6 December 1861, Royal Botanic Gardens, Kew Library (hereafter RGBK) (Zambezi Expedition Book, 18–23).

57 John Kirk to William Hooker, 19 December 1861, RGBK (Director's Correspondence v.42/163).

58 A letter to Joseph Hooker the previous day (18 December 1861) indicates this. RGBK (Director's Correspondence v.42/162).

59 Kirk to W. Hooker, op. cit. (56).

60 John Kirk to Joseph Hooker, 9 January 1861, RGBK (Director's Correspondence v.42/167).

61 Natural History Museum of London (hereafter NHML) (Owen Correspondence, 62.16/437–40).

62 Sponsored by the Royal Geographical Society, Burton and Speke travelled from Zanzibar to Lake Tanganyika from 1857 to 1859 and made preliminary observations of the southern shores of Lake Victoria. Kirk may have seen S. Woodward, 'On some new freshwater shells from Central Africa', *Proceedings of the Zoological Society of London* (1859), 348; and R. F. Burton, 'The lake regions of central Africa', *Journal of the Royal Geographical Society* (1859), 29, 1–454.

and their relative importance. If the mussels he collected were of the same species as those found by Burton and Speke, then a strong argument could be made that Lakes Nyassa and Tanganyika were connected by a river. This revelation would have provided further evidence in the ongoing efforts to determine the sources of the Nile. At the time Kirk was sending the shells to England, Speke was crossing into the Kingdom of Uganda, trying to prove that Lake Victoria was the source of the Nile.⁶³ Knowledge of this must have highlighted for Kirk the importance of the Lake Nyassa specimens and helps explain why he was keen to get them home and described as quickly as possible.

The shells, with other mails and specimens, went with HMS *Gorgon* when it left the Mozambique Channel for Cape Town on 4 April 1862. The cases were taken to Simon's Bay and then transported to Sheerness Yard, at the mouth of the Medway on the Thames estuary, by HMS *Cossack* and were addressed 'through the Secretary of State for Foreign Affairs to Kew Gardens'. The Admiralty notified William Hooker on 9 September of their arrival and a few days later the specimens were sent by train to Kew.⁶⁴

The case holding the shells was opened along with ten others at the Kew Museum for Economic Botany on 16 September 1862.⁶⁵ The shells were forwarded to 'Prof. Owen, Brit. Museum'. The rest of the material remained at Kew because Kirk specifically requested this of William Hooker in the letter of 6 December 1861.⁶⁶ It was understood that the context necessary to fully understand and classify the specimens would be lost if they were dispersed before his return home. In a letter to John Washington, Livingstone instructs that botanical and zoological specimens must remain with Joseph Hooker at Kew, 'till the arrival of the collector, whose knowledge ... will be most advantageous in classification'.⁶⁷ Aside from the mussel shells and a few other specimens, the bulk of the zoological materials remained packed in crates at the herbarium for two years waiting for Kirk. It would appear that moving from local to universal knowledge here required the physical presence of the collector, who stood as proxy for the Zambezi basin, confirming the natural habitat of specimens. Without his presence, the specimens could lose their local meanings and were in danger of becoming dislocated curios. Though Kirk would not be the author of the descriptions of most of his collection, zoological and botanical, he still held control over their fate.

Kirk's credible reputation in London's scientific community may be understood through contrast with the controversy surrounding Paul du Chaillu and his description of gorillas in the wild. Published in May 1861, his narrative was fiercely criticized by some members of the zoological profession, notably John Edward Gray, Keeper of Zoology at the British Museum.⁶⁸ Du Chaillu attempted to cross the line from mere

63 J. H. Speke, *Journal of the Discovery of the Source of the Nile*, Mineola, New York, 1996 (1st edn: Edinburgh, 1863), 197–309.

64 Letters from the Admiralty to William Hooker, RGBK (Zambezi Expedition Book, 32–5).

65 The entry book listing for the day reads, 'one small tin box of shells'. RGBK (Economic Botany Collections, Museum Entry Book, 102.1862).

66 Kirk to W. Hooker, op. cit. (56).

67 6 January 1862, published in W. Clendennen Gary, 'David Livingstone on the Zambezi: letters to John Washington, 1861–1863', *Munger Africana Library Notes* (1976), 32, 1–89.

68 P. B. du Chaillu, *Explorations & Adventures in Equatorial Africa*, London, 1861.

collector to scientist without possessing the necessary credentials and thus brought controversy upon himself and his defenders. Many of the details of his account fell under doubt. McCook's analysis of the du Chaillu affair demonstrates that collectors who lacked scientific authority were meant to remain relatively invisible, trusted to collect but not to conclude.⁶⁹ Kirk, on the other hand, authored his own scientific papers where he felt capable, bowing to others' authority where he did not. He was commonly mentioned and cited in papers where his specimens were described. Neither his credibility as a fieldworker nor his authority as a scientist were ever called into doubt – he operated smoothly in both capacities and approached the Victorian ideal of a fieldworker: reserved, daring and scientific.⁷⁰ Keeping most of the Zambezi collections sealed, until Kirk returned and opened them himself, allowed the chain of credibility from the field to the published description to remain tightly linked. The mussels, however, were particularly interesting. Their description could not wait and so they were sent ahead.

At the British Museum the specific donation entry for the mussels reads, '1862 October 8th, a collection of shells, collected during Dr. Livingstone's Expedition and presented by Dr. Kirk. Post Office, Cape of Good Hope.'⁷¹ Although this entry would appear to indicate the shells in question, it is not clear why they are listed as coming through the Cape Post Office and this form of registration does not match the information found at Kew Gardens. This can be interpreted as a clerical mistake, for the other evidence presented above suggests conclusively that the shells went to the Museum via Kew; their dates of arrival at Kew and the British Museum correspond to the parcel's description.

In tracing the movement of specimens from Kirk's hands via Admiralty ships to Kew and then the British Museum, we are tracing lines of authority that linked field collectors to metropolitan research centres. Trust was placed in those who transported the specimens and those who took responsibility for them. Kirk does not indicate in his letters that he had an analyst for his specimens in mind. Instead, Richard Owen, as superintendent of the natural history departments of the British Museum, was expected to deal with the collection appropriately. In this role, Owen acted as an integral part of a network upon which the expedition's scientific credibility and significance would depend.

The shells next appeared in the *Proceedings of the Academy of Natural Sciences of Philadelphia* on 12 April 1864. In his 'Descriptions of Six New Species of UNIONIDAE from Lake Nyassa, Central Africa, &c.' Lea wrote,

The specimens herein described are of unusual interest. They are the first which I have seen from Central Africa, and I am greatly indebted for them to the liberality of John Kirk, M.D., of Edinburgh, who accompanied the Zambezi Expedition, under the British Government, as Medical Officer and Botanist. There are six in number, all of which I believe to be undescribed. ... The three Uniones differ from any type I have heretofore seen from

69 S. McCook, "'It may be truth, but it is not evidence': Paul du Chaillu and the legitimization of evidence in field science", *Osiris* (1996), 11, 177–99.

70 Exposure to danger in the field could lend the collector more authority in the metropolis. See B. Hevly, 'The heroic science of glacial motion', *Osiris* (1996), 11, 66–86.

71 NHML (Zoological Donations Record, 1848–73. DF216.28).

Africa. ... It is greatly to be regretted that none of the soft parts were preserved, that we might compare their anatomy with those from America. Lake Nyassa is one of the three great central lakes of Africa, and has a southern drainage in the Zambezi River. It is, in extent, as Dr. Kirk informs me by letter, 'exceeding two hundred miles north and south, and from fifteen to sixty miles wide, and is fifteen hundred feet above the sea. It lies between the parallels of 14° and 18° south latitude'.⁷²

Lea described the specimens and, with acknowledgement to their home environment and collector, named them *Unio kirkii*, *Unio nyassaensis*, *Unio aferula*, *Spatha alata*, *Spatha modesta* and *Spatha nyassaensis*. This article was collected with others and republished with plates in the Academy's *Journal* a few years later (see Figure 1). Tracing in detail the shells' movement from Kirk to Lea via Owen as intermediary is not easy. Letters from Kirk to Lea appear not to have survived and it is unclear if the letter to which Lea refers above was personally written to Lea by Kirk, or if it was a general letter accompanying the specimens. Kirk never had an opportunity to meet Lea and they do not appear to have known each other personally. But, as shown above, Lea was a close personal acquaintance of Owen and others working at the British Museum.

Given what we know from Dohrn's article, it is clear that the unionid shells were selectively removed from the main collection and specifically sent to Lea for analysis.⁷³ Others were qualified to do this work. Dohrn certainly implies that he could have done the job and did not approve of splitting the collection in the first place. According to Dohrn, splitting up the collection between analysts diminished its value as evidence for the biogeography of mussels in southern Africa. Despite these problems, instead of keeping the shells together and using a more local specialist, the *Unio* specimens were separated out and sent to Lea. When the remainder of the shells were sent to Dohrn for description, no unionids were included, possibly to avoid any priority dispute or confusion in naming. So if there were duplicates retained at the British Museum, Dohrn was clearly not allowed to see them, and hence his 'regret'.⁷⁴ Dohrn was very much acknowledged as an expert in malacology, but Lea was the established expert on unionids. In 1863 Lea had been sent unionid molluscs recently collected in South America by Patricia María Paz y Membiela, former director of the Spanish Comisión Científica del Pacífico. This demonstrates that Lea's expertise was widely acknowledged in the early 1860s and he was receiving specimens of this family from government-sponsored expeditions worldwide.⁷⁵

Described, named and published in Lea's articles, the mussels were then fully incorporated into Western scientific knowledge. They had been moved from the farthest empirical and geographical peripheries into the metropolitan knowledge system epitomized by London's scientific institutions. In following the mussels to their final destination we

72 I. Lea, 'Descriptions of six new species of Unionidae from Lake Nyassa, Central Africa, &C.' *Proceedings of the Academy of Natural Sciences of Philadelphia* (1864), 16, 108–9. Lea errs here as he recorded in his diary previously seeing Zambesian *Unio* specimens when he was Berlin in 1853. See the discussion of Lea's European tour of 1852 and 1853, above.

73 Dohrn, op. cit. (31).

74 Dohrn, op. cit. (31), 234.

75 L. López-Ocón and S. Badía, 'Overcoming obstacles: the triple mobilization of the Comisión Científica Del Pacífico', *Science in Context* (2003), 16, 504–34.

find, however, that the metropolis relocated itself along lines of credibility and authority leading to Lea in Philadelphia, where the journey ended. This raises questions, to be discussed in the conclusion, over what might be meant by terms such as ‘centre of calculation’ and how we are to understand the geography of the ‘metropolis’.

Conclusion

The complexity of activities constituting expeditions – some mundane, some recoverable but others less so, yet all about the doings of science – explains the subtitle of my paper, a geography of the Zambesi Expedition.⁷⁶ There are numerous other possible geographies that could be described, depending upon those aspects of the expedition’s work chosen as the subject of interest. The ‘spatiality’ of the expedition described here is but one of many factors contributing to the construction of a natural history of the Zambezi basin through this expedition.⁷⁷ Indeed, the life histories of the key players in the story of how the mussels were described are offered as another important aspect of understanding fieldwork and the distribution of specimen collections.

This case study seeks to demonstrate the importance of travel in making the networks of natural history possible. Travel brings people, ideas and specimens to places in the form of expeditions, and it carries them away. By tracing the trajectory of the shells, a number of other journeys besides that of the expedition itself have become important. Understanding these journeys provides important evidence concerning the social geography of mid-nineteenth-century science and the intricate connections between field collectors, institutions and ‘analysts’. Kirk and Lea, not otherwise connected, were brought together by a tin box of shells, by intermediaries in London’s scientific institutions and by Lea’s established reputation.

If we may think of the British Museum as a Latourian ‘centre of calculation’ in this case, where further work is done to ‘mop up the inscriptions’, then it must occupy a space stretching from Philadelphia, across London, to Berlin – an unwieldy image that is overly reductive.⁷⁸ By following the mussels through society, the centre of calculation proves to be a fictitious place if it is assumed to be the end of the line where all the further analytical work was performed. Here, the metropolitan centres of science acted to propel the specimens further along their epistemic journeys as material collected on the expedition was dealt with, literally, on a case-by-case basis. The work at the museum involved receiving specimens, evaluating them briefly and then sending them on to an appropriate expert for proper analysis, wherever they might be.⁷⁹ This taxonomic triage may be reviewed today in the rough identifications given to specimens

⁷⁶ I highlight the possibility for other geographies due to the multifaceted nature of expeditions; not, in this case, due to what D. N. Livingstone has styled a ‘postmodern inclination to expunge the definite article’. M. Hoyler, T. Freytag and H. Jöns, ‘Geographical traditions, science studies and biography: a conversation with David N. Livingstone’, in David N. Livingstone, *Science, Space and Hermeneutics*, Heidelberg, 2002, 77.

⁷⁷ Steven Shapin has called for a more robust geographical perspective in the history of science in which travel is key. See Shapin, *op. cit.* (4).

⁷⁸ Latour, *Science in Action*, *op. cit.* (9), 233.

⁷⁹ The expert could very likely be located at the museum, or perform the work there. In this case, the ‘sending on’ was an operation internal to the institution, yet the type of decision made about the fate of specimens remained the same.

in museum accessions registers and donation books. The point of the exercise was to get a quick idea of what was arriving so that a specialist could be assigned to identify them. Differences in the quality of initial classifications can be attributed to the skills of whichever individual was responsible for opening the box.⁸⁰ In this role, the British Museum functioned less as a ‘centre of calculation’ and more as an entrepôt for natural history.

Once distributed, specimens came under analysis. Nearly one hundred articles that directly utilized material or data collected by the Zambesi Expedition appear in scientific periodicals between 1858 and 1867. Not all of the authors were located at the British Museum or Kew Gardens. The host periodicals represent a variety of leading scientific societies including the Linnean Society, the Royal Geographical Society, the Royal Society, the Epidemiological Society and the Academy of Natural Sciences of Philadelphia. Distributing specimens for analysis was an important part of the work done in connection with the expedition and it was work that relied heavily upon established professional networks. Specialists were identified through their reputation in publication and via personal acquaintance. Geographical location or ‘in-house’ status may have also been important when assigning workers to identify specimens, but in this case no one at the British Museum was considered capable. These networks were not always planned in advance but, rather, were established contingently, depending upon the types of specimen produced. The minimal prior planning given to this aspect of the expedition demonstrates further the authority that the British Museum and Kew Gardens possessed as sites where the identification of specimens would be facilitated, but not necessarily undertaken. Sending specimens there was a necessary stage of the route to their full analysis. The ‘normal’ and unremarkable nature of these networks, then, is one reason why it is now so difficult to retrace such movements; records of these activities were not diligently kept.

This difficulty in retracing specimen trajectories may help explain why the use of specific collections or particular specimens as evidence for the social construction of natural knowledge is not often attempted by historians of science, though these types of investigation can prove fruitful. Difficulties arise where the contextual ‘history’ of a specimen has been lost because it was not considered as important as its morphology and geographical origin. As correspondence that accompanied specimens may not have made it to institutional archives but, correctly, remained with the specimen, important documents might be destroyed, lost or otherwise irretrievable. Furthermore, natural history collections may not be cross-indexed by collector or expedition at all, thus demanding arduous sleuthing to identify a collector’s specimens. Lastly, few, if any, ready-made search methods allow for the retrieval of publications ranging across disciplines that made use of a particular expedition’s materials. This case study is itself limited by such lacunae.

The example of the six unionid shells illustrates how fieldworkers possessed varying control over the later representation of their specimens. For example, in Dohrn’s article on the *Unio* specimens, Kirk is only quoted to provide information concerning local

80 Thanks are due to Dr Colin MacArthy, Collections Manager for Reptiles, Amphibians and Fishes at the Natural History Museum, London. Our discussion of the accessions registers and his assistance in locating examples of Kirk’s specimens was invaluable.

context and regional distribution.⁸¹ Likewise, others cited Kirk in their articles naming specimens from the Zambezi collections, adding his first-hand knowledge of context (e.g. location, habit and uses) to desiccated taxonomic descriptions. In this guise, Kirk, as a fully trusted collector, acted as an avatar for the Zambezi basin.⁸² Bringing the foreign space with him into these texts, Kirk repositioned the specimens back in the field. Fully incorporated into the forms of knowledge by which they must now be defined, the specimens could be imagined as if *in situ*, though now classified.

In Philadelphia, Lea used Kirk to interpret Lake Nyassa for his readers, even though Kirk never travelled to North America and the two never met.⁸³ Incorporating Kirk's voice in the rhetorical structure of the paper by quoting his description of the lake, Lea retraced the journey made by the shells outlined here and took the reader back to the field and the site of collection. From a reader's perspective, Kirk lifted the specimens from the lake and handed them to Lea. The distance between cabinet and field was rendered minimal and the many local decisions that kept the shells moving from Lake Nyassa to Philadelphia were obscured – a necessary rhetorical consequence if the local specimens were to have universal scientific significance.

This paper has examined the role of both local and distributed sites for knowledge production. Lea worked in Philadelphia in the private spaces of his study. Kirk roamed central Africa collecting at particular sites. Others at Kew Gardens and the British Museum acted to facilitate specimen identification. The sites of collection, facilitation and analysis are particular locales that fit into a larger, distributed pattern of knowledge generation necessary for the whole project to succeed. The Zambesi Expedition may be understood as the sum of these dislocated activities. Performing this sum requires that local and distributed modes of work are considered – indeed the historiography itself must be spatialized.⁸⁴ As D. N. Livingstone has remarked, such work requires that we 'attend to spatial considerations at a variety of scales'.⁸⁵ This has been necessary in order fully to understand how expeditions contributed to spatially and temporally extended 'projects' such as unionid systematics and in order to provide a historical account that reflects this extension. The key that links the scales and defines the spaces in this study are the mussels we have been following. Normally considered rather sedentary creatures, they provided the *raison d'être* for a host of thoroughly mobile scientific activities.

81 Dohrn, op. cit. (31).

82 For examples of this, see G. Bentham, 'On African *Anonaceae*', *Transactions of the Linnean Society* (1862), 23, 463–80; J. E. Gray, 'Notes on some new lizards from South-Eastern Africa, with the description of several new species', *Proceedings of the Zoological Society of London* (1864), 58–62; *idem*, 'On *Urocyclus*, a new genus of terrestrial Gasteropodus Mollusca from Africa', *Proceedings of the Zoological Society of London* (1864), 250; *idem*, 'Notice of a new species of Galago from Quillimane (*Otogale Crassicaudata* Var. *Kirkii*)', *Proceedings of the Zoological Society of London* (1864), 456–8; J. R. Jackson, 'Notes on some African vegetable products', *The Technologist: A Monthly Record of Science Applied to Art, Manufacture, and Culture* (1864), 4, 471–7.

83 Lea, op. cit. (72).

84 Harris, op. cit. (1), 294.

85 Livingstone, op. cit. (14), 27.